ILLUMINATING ENGINEER

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INDEX

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STREET LIGHTING

STREET LIGHTING DEMONSTRATION AT THE LIGHTING SERVICE BUREAU

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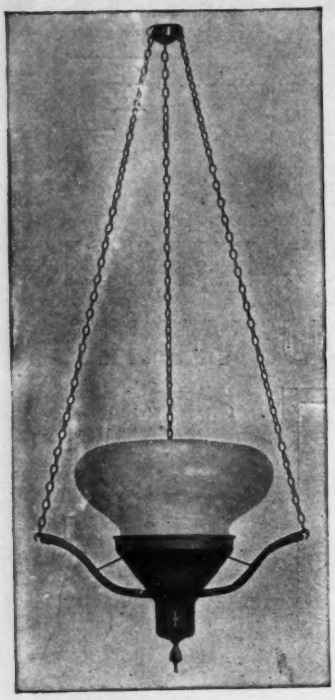

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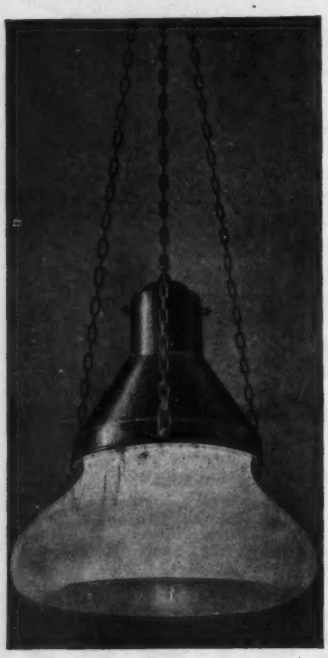

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Experiences of Industrial Lighting in the Sheffield Area

ABOUT a year ago we presented a summary of an investigation of industrial lighting conditions conducted by Mr. F. E. Shopland, one of H.M. Inspectors of Factories. We now present (pp. 207–211) a similar survey by Mr. R. W. Daniel of various special trades in the Sheffield area such as silversmiths, cutlery, and the making of edge tools and small steel products.

Generally speaking the standard of factory lighting in Sheffield is considered poor. Whilst the industrial depression is blamed, the real cause is evidently lack of interest and insufficient knowledge. "In the old days no one bothered—being too busy; to-day still no one bothers—being too slack." Apart from sheer want of understanding—on the part of contractors as well as owners of factories—the cost of modern reflectors has been urged as a deterrent. This has led certain firms to manufacture their own equipment from scrap metal. Even when there is ample consumption of gas or electricity for lighting much light is lost by poor methods—the shallow conical reflector even to-day being apparently almost universal in certain areas. In other cases neglect of maintenance and the accumulations of dirt have resulted in illuminations far below their proper value. One odd explanation of insufficient use of electricity for lighting is given—the tariff until recently in use whereby only 5 per cent. of the power used was permitted for lighting purposes at 1d. a unit, the remaining expenditure on lighting being charged at 4d. per unit. The natural result was that many firms restricted consumption and development of lighting so as to keep within the 5 per cent. limit. The tariff has since been revised and 20 per cent. of the power demand is now allowed at the lower rate; but we confess that we still dislike an arrangement which makes lighting conditional on power demand and seems to set an upper limit to expenditure on illumination.

Another instructive example of the effect of "the human element" is to be found in the numerous tenement factories, almost all exceedingly poorly lighted. Here again the existing arrangement whereby the landlord and not the occupier determines the method of lighting is clearly unfortunate. The tenement proprietor has little to gain monetarily from improvements in lighting; the occupier, even when conscious of the deplorable conditions, is usually unable to meet the expense of a single installation in a room of which he is merely the tenant. Hence the prevalence even to-day of flat-flame gas burners and working illuminations ranging from 0.125 to 0.5 foot-candles, whilst electric light fittings, where provided, are left to become dirty, old and worn out. That the men are aware of the handicap thus imposed on their efforts is shown by the results of some informal tests organized by workers, revealing a loss in output of the order of 20 per cent. when the artificial light was substituted for daylight.

On the other hand it is curious to observe cases in which workers, accustomed to local glare, raised instant objection to its elimination—declaring that the illumination was no longer adequate when the lamp was temporarily screened from view by a hat or notebook. In the report a psychological explanation is put forward—that the worker cannot accept that he is getting full value when he is no longer able to see the light. But another and perhaps more probable explanation—especially as it was apparently the older workers who raised objection—is that in these cases the glaring light, by causing the pupil aperture of the eye to contract, did actually give rise to clearer vision, even though the prolongation of the process must inevitably occasion strain.

Several instances of the lighting problems that arise in connection with specialized industrial processes are given. Amongst these may be mentioned the requirements of testers of safety razor blades, an exacting process for which a high illumination is desirable, but in which reflected glare is apt to play an important part. In other processes, involving the inspection of highly polished material, the use of diffusing media so as to produce a source of extensive area and moderate brightness has been found advantageous. Also interesting is the recognition in up-to-date works that the blackening of walls and ceilings in silversmiths' shops is not essential or even a desirable process.

We are very glad to have an opportunity of making known some of the excellent work that Mr. Daniel has done in the Sheffield area. His report shows considerable insight into the practical difficulties and human imperfections that tend to delay progress in industrial lighting. It also illustrates the tactful and sympathetic influence which H.M. Inspectors of Factories so often bring to bear in the course of their visits—an influence that often effectually paves the way for advances towards better lighting conditions.

The Life-preserving Rôle of Good Street Lighting

We have now before us a copy of a paper on the above subject, read at the 27th Annual Convention of the Illuminating Engineering Society (U.S.A.) by Mr. R. E. Simpson, who is an expert in this particular field. Mr. Simpson confirms the suggestion recently made in these columns that the proportion of street accidents occurring in darkness tends to rise steadily year by year; in 1932 45·1 of accidents and 53·4 per cent. of fatalities occurred at night time. By means of a diagram Mr. Simpson also demonstrates one striking fact—that the ratio of night to day accidents increases inversely with the expenditure on public lighting. Taking the day accidents as 100, it appears that for street lighting costs per capita of over 1·50, 1·50, 1·00 and under 0·50 dollars, the figures for the night accidents become approximately 130, 165, 200 and 240. Another significant fact is that whereas, in 1932, there were 32 fatalities for every 1,000 accidents during the daytime there were 46 deaths per 100 night accidents. The most instructive feature of the paper, however, is the opportunity it affords of studying the results of diminished expenditure on street lighting.

In the case of 22 cities which increased their expenditure on street lighting, showing an average increase of 11 per cent. for 1932 as compared with 1931, the fatalities in the streets during the hours of darkness showed a diminution of 23 per cent. On the other hand in the case of 20 cities showing decreased street lighting budgets, an average decrease of 14 per cent., there was a 7·6 per cent. increase in the number of fatalities during the hours of darkness. Similar results are shown if all automobile accidents, fatal and non-fatal, during hours of darkness are considered. The drawing of inferences from statistics such as these, where the influential factors are so numerous, is notoriously difficult. It does seem, however, that a clear lesson is to be drawn from these data—the first attempt, we believe, to trace a relation between "economies" in public lighting and safety in the streets.

The Response of Greenhouse Crops to Artificial Light

From time to time researches have been published showing how, by supplementing daylight by artificial light, plants can be brought into bloom earlier and bigger and better flowers and foliage can be secured. Past experiments have usually been made with relatively high illuminations, and we have previously suggested that a closer study of requisite intensity, period of irradiation and quality of light would be fruitful. In this respect a contribution by Mr. R. B. Withrow, presented at the 27th Annual Convention of the Illuminating Engineering Society (U.S.A.), is highly suggestive. In the earlier experiments illuminations of the order of 450 ft.-c. were used, a value which certainly yielded promising results but seemed likely to prove prohibitive as regards cost. Fortunately these later experiments seem to suggest that such high illuminations are not necessary. Excellent results were obtained from a wide variety of plants irradiated at 13 ft.-c., and other experiments suggest that very much lower illuminations will answer quite well. For example when stocks, pansies and asters were illuminated to intensities varying from 1½ to 110 ft.-c, the lower values gave just as good results as the higher ones, and in the case of the pansy even led to better quality of flowers. Other experiments suggest that in general blue-violet light has an arresting and red light a stimulating effect on growth. In regard to period of irradiation, further study is needed, though in some cases a five-hour period seemed to be the most economical one. Of special interest is the author's final calculation of costs. With pansies 1 watt per two sq. ft. of space, yielding an illumination of ¾–1½ ft.-c., gives good results. This involves an expenditure of less than 4½ cents per 100 blooms, which sell wholesale for 1 to 1½ dollars. The cost of lighting was thus only about 4–5 per cent. of the selling price.

An Improved Light Distribution Visualizer

Three workers, Horioka, Satow and Fukushima, at the Japanese Electro-technical Laboratory,* have described an improved form of apparatus for showing visually the polar curve of light distribution from lighting units. As might be expected in these days, a photo-electric cell is the "eye" of the instrument: a gas-filled caesium cell combined with a Wratten K filter is used. A set of 36 plane mirrors are arranged as the frustum of a cone and set at such angle that the light from a centrally placed light-source is focussed at a point on the axis of the cone. Before reaching this point, however, the light is intercepted by a plane mirror mounted on a rotating disc, the axis of rotation being coincident with the axis of the cone. The rate of rotation is at least 16 r.p.sec. The light from the rotating mirror is received on the sensitive surface of the photo-electric cell (which is again placed on the axis of the cone). A powerful amplifying arrangement is used and the resultant current is passed on to a short period oscillograph vibrator, with a natural frequency of about 1,000 per second. The light beam reflected from the mirror of the vibrator is projected on to a fluorescent screen. Owing to the speed of rotation of the plane mirror, the 36 points of light corresponding to steps of 10° round the light-source under examination appear to link up and form a polar curve as a steady line of light on the screen. Some precautions that are necessary to obtain reliable results are dealt with in detail, and a few photographs of typical light distribution curves indicate that interesting results can be obtained, though no great degree of precision appears possible at present.

* Researches of the Electro-technical Laboratory No. 296.

Some Observations on the Lighting Conditions for Basic Industries in Sheffield

IT may be recalled that last year we presented an informative survey of lighting conditions in 213 factories in various parts of England and Scotland, conducted by Mr. P. E. Shopland (H.M. Inspector of Factories). That report dealt mainly with foundries and engineering and certain allied trades such as lace making, embroidery making, artificial silk making, etc.*

We have now been afforded an opportunity of studying a somewhat similar, but more detailed, report prepared by Mr. R. W. Daniel, B.S., A.M. Inst. C.E., another of H.M. Inspectors of Factories, in Sheffield. In this enquiry a total of 338 visits were paid to factories and observations were made in 273 different factories. The factories were distributed approximately as follows: silversmiths, 59; cutlery, 108; electroplating, 16; edge tools and small steel products, 61; engineering, 17; woodworking, 4; steelworks, 50; abrasive wheels, 1. Sixty-five re-visits were also paid in order to study improved lighting conditions in certain factories. Altogether 946 photometric readings in 92 different factories were taken.

It was found that the standard of factory lighting in Sheffield is poor. In most cases the available light source is not effectively used, in many instances—especially in tenement factories—the actual amount of light provided is inadequate. Several years of depression are insufficient excuse, since little improvement was carried out in the preceding prosperous period. A remark that "In the old days, no one bothered—being too busy; to-day still no one bothers—being too slack" seems aptly to summarize a common attitude. Bad lighting commonly results also from alterations in the layout of plant, without the necessary rearrangement of the lighting installation being made.

There are, however, other factors that have hindered improvement:—

(1) *Lack of information.* Although many Sheffield factory managers are aware of the advantages of good lighting, as shown by the interest in this enquiry, they lack standards of comparison, and installations suffer accordingly. Too often comparisons are made with the lighting of the factory in the past, instead of with progressive competitors in the present.

Local lighting contractors, unacquainted with recent progress in industrial illumination, are also frequently to blame. A common fault is the installation of unsuitable fittings, *e.g.*, fittings of shallow conical reflectors in an installation of 600–60 watt and 100 watt local points. In the only really well lighted factories visited the installations had been designed by large contractors, specializing in industrial lighting.

This difficulty of inexperience can most readily be overcome by practical demonstration. In this connection, the suggestion of a Corporation Lighting Service Bureau was received with interest by local government officers approached, and a conference will shortly be held to consider the scheme. It is also hoped to give a public lecture on the subject of factory lighting at the beginning of next winter.

(2) *Cost of Reflectors.* The relatively high cost of modern electrical reflectors is mentioned as another important factor. In certain cases firms have manufactured their own supply; for example, in one case 2,000 reflectors were stamped out from scrap sheet steel. In another case the reflectors were made by spinning and polishing Britannia metal; the cost in this case worked out to 5s. each.

(3) *Rates for Industrial Lighting.* Progress has also been retarded by the methods of charge hitherto adopted for electricity used for lighting. The original tariff provided that 5 per cent. of the power used was permitted for lighting purposes at 1d. per unit and the remainder being charged at 4d. per unit. As a result, many firms restricted consumption and development in order to remain, as far as possible, within the 5 per cent. power demand rate. Since the beginning of the enquiry however, the tariff has been revised and 20 per cent. of the power demand, in place of the original 5 per cent., is now permitted for lighting at 1d. per unit. This factor alone should produce considerable improvement.

Wherever possible efforts were made to obtain improvements. Although, during the time of acute depression, wholesale action could not be expected, many firms were glad to make use of photometric readings and to receive recommendations. In 41 factories major improvements were decided upon, and in 45 other cases minor improvements (such as screening of the most glaring sources) were promised. In the original report the author presented details of suggested improvements, many of which have already been completed or are known to be already in hand.

Effects of Glare. In the majority of factories visited, glare was prevalent, in fact only three factories were entirely free from it. In an attempt to obtain systematic comparisons of glare the accompanying table presenting glare severity figures has been prepared.

COMPARATIVE GLARE SEVERITY TABLE.

Industry—Process	Free from glare %	Per cent. Glare severity G_1	G_2	G_3
SILVERSMITH.				
Industry as a whole	10	43	34	13
Bench work	27	39	23	11
Buffing	16	60	16	8
Electroplating	10	70	20	—
CUTLERY.*				
Sheet rolling	23	70	5	—
Blanking out and drop-stamping	25	60	15	—
Grinding: Electric-lighting	33	50	17	—
Incandescent gas	—	50	25	25
Buffing	15	28	38	19
Packing and polishing	40	40	20	—
STEEL TOOLS.				
*Saw grinding	14	36	24	24
Joiners' tools	23	57	12	8
*Do. omitting grinding	10	30	50	10
Engineers' tools, gauges, etc.	36	48	12	4
*STEEL FORGING AND ROLLING	27	60	13	—
FOUNDRIES	35	40	20	5
*HEAVY ENGINEERING	30	50	10	10

* Estimated from limited observations only.

NOTE.—

G_1. Some glare; from lower power local pearl bulbs partly screened, light background, and similar.

G_2. Bad glare; from higher power bulbs unscreened, and/or closer range, medium background, and similar.

G_3. Very bad glare; clear or G.F. bulbs unscreened, close range, dark background.

Completely unscreened bulbs are chiefly responsible for the more severe cases of glare, but the great majority of cases result from the continued use of the

* *The Illuminating Engineer*, September, 1932, pp. 213–215.

old pattern 10-in. shallow conical reflector. Only six factories visited were free from the use of these fittings. In all other factories shallow conical reflectors were adopted, in some cases spoiling to some extent the advantages derived from adjacent newer fittings. The common practice of attempting to combine local and general lighting by fixing a higher power lamp in these shallow reflectors at a height of six to eight feet above the floor level, usually caused both glare and inadequate lighting. Such reflectors were found in approximately 300 factories, and in no case had any effort been made to effect improvement by the attachment of any permanent skirt though the original paper screening was occasionally employed.

In three factories, the top holes of some of the reflectors had been enlarged so that they rested on the glass necks of the bulbs, thus lowering the rim of the reflector and effectively screening up to 40 watt lamps and cause some increase in illumination; but mechanically this is unsatisfactory and a make-shift device. For various reasons all the firms with whom this matter was discussed maintained that the provision of permanent metal skirts was not a satisfactory proposition.

In certain cases the older workpeople accustomed to local glare raised instant objection to its elimination, declaring that the illumination was no longer adequate even when the sources were temporarily screened from view by a hat or note-book. The impression gathered is that with a long glaring local point suddenly screened, the operative concerned is less conscious of its presence, and, *ipso facto*, there is less light.

Maintenance.

Of the factories visited only three (1·1 per cent.) provided for systematic maintenance of the lighting installations. In numerous instances measurements of illumination taken under expensive modern fittings showed that double or treble the amount of light was obtained after accumulated dust had been removed. Regular cleaning is chiefly neglected in cases of elevated points and with types of lighting fittings in which the bulb and accumulated dirt are hidden from view. In one typical instance a dirty local intensive reflector, equipped with a 100-watt daylight bulb, gave an illumination, when clean, of 105 ft.-c. at bench level, as compared with 42·5 ft.-c. before cleaning. In many cases the management showed great surprise at the results of such demonstrations. Where anxiety was shown to ensure proper cleaning for the future, the suggestion was made that a register of cleanings be kept, and checked by the main office—an expedient subsequently adopted by one large firm.

Silversmiths.

Factory conditions in the cutlery and silversmith's trades are closely allied, many factories simultaneously carrying on both processes. The silversmith trade has, in the main, the advantage of being confined to larger factories, yet the buildings are, with few exceptions, of very old construction and on the multiple separate room principle. Such structural conditions necessarily limit the efficiency of the artificial lighting obtainable.

The actual conditions prevailing, however, are inexcusably poor, and even limited attention and capital outlay would effect considerable improvement. Of 59 factories visited, only five had made any apparent attempt at recent modernization. Absence of work after 4 p.m. in many of them for several years past must, however, be borne in mind.

All but six of the factories visited were electrically lit. Serious inadequacies were rare, but dirty and unsuitable bulbs and fittings, haphazardly arranged and with a high frequency of glare, were common. A wide dissimilarity of intensities of illumination for similar processes, even in the same factory, was also observed. Thus in the same polishing and packing warehouse readings were found to vary from 4 to 12 ft.-c., and in similar buffing processes from 2 to 15 ft.-c., and in hand beating of pewter-ware from 3½ to 25 ft.-c.

Gas lighting has been retained in several silversmiths' shops, where it is claimed to give a whiter and more satisfactory light for work on highly polished metal surfaces than does ordinary electric light. Gas installations were well maintained, but unscreened and very glaring.

It is possible that greater use of diffusing units might advantageously be made in this industry. In a certain factory the manager (at age 53 years) developed acute cataract, diagnosed by a specialist as the outcome of prolonged observations of polished metal in strong concentrated light. After treatment he had largely discontinued this work, except in cloudy daylight. An application of the overhead illuminated linen screen used in stainless steel strip examination was suggested and experiments proved markedly successful. The advantage rests chiefly in even illumination of curved polished surfaces, with the elimination of extraneous images and bright patches. An enclosed lighting unit is to be constructed by next winter.

In view of past enquiries in the matter, observations were made of the practice of " blackening " of walls and ceilings in certain silversmiths' shops. Only a few long-established firms appear to continue the practice, and in the more progressive of these, it remains largely in deference to the wishes of older workpeople. The walls of rooms occupied by younger women engaged on similar processes may be of light-coloured distemper. In the electro-plate and pewter-ware trades, a more modern industry, such " blackening " is rare.

The best evidence was obtained in one of the few large silversmiths that have removed to a modern factory. At the time of the removal, the manager, whilst conceding certain slight advantages in blackened walls, decided that they were outweighed by the unsatisfactory appearance resulting. The walls were accordingly distempered light red ochre, and the ceilings white. On removal, considerable complaint was voiced by the women hand burnishers who professed marked difficulty in working. They were persuaded however to accept a month's trial, during which time attention was frequently drawn to the added cheerfulness, etc., of lighter colouring. By the end of the month, the opposition was largely withdrawn and the conditions remained. The two remaining burnishers of the older regime are now wholly in favour of the lightened colour, and the twenty younger girls have known nothing else. Light-blue and green have also been tried, but the original red ochre is claimed to have proved the most satisfactory.

Cutlery.

The various processes of the Sheffield cutlery trade are carried on in all sizes and types of factories. A few are of modern construction, but most of them are old and divided into numerous separate workrooms.

The general standard of lighting is poor. Glare predominates in many cases and arrangements for maintenance are negligible. In most cases lighting conditions are static or even deteriorating. Bad trade is partly responsible, but even where the financial position is favourable little effort is made to introduce better conditions, and in some cases, even in new installations, wrong methods are pursued. For example, in a newly built factory, 600 local points were fitted in shallow conical reflectors, giving rise to severe conditions of glare. Had modern local reflectors been provided, improved efficiency and reduction of consumption of power would have compensated within a few months for the greater initial cost.

In the original report, particulars of the methods of lighting customarily used for different processes and the approximate values of illumination (which vary within wide limits) are given. In this connection the following table is of interest.

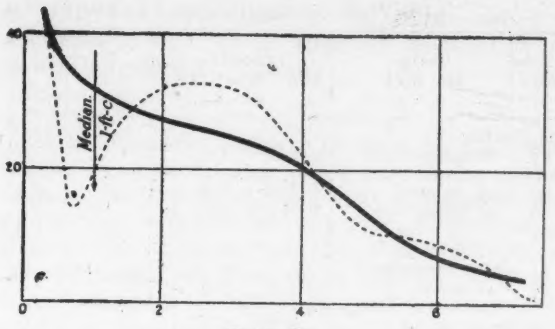
Types of Lighting in Cutlery Factories	No. of Factories	Intensities (foot-candles)
Electrically lit :		
Local points in shallow conical reflectors with some glare ..	11	2 —8
No screening whatsoever :—		
40–100w. pearl bulbs with bad glare	5	1½—2½
60–100w. clear bulbs with very bad glare	3	2 —5
Absence of local glare due to elevated positioning	2	2½—5
Effectively screened by suitable local reflectors	3	6 —16
Gas lit :		
Absence of local glare due to elevated positioning	3	2½—5
No screening with bad local glare ..	2	2 —7

Tenement Factories.

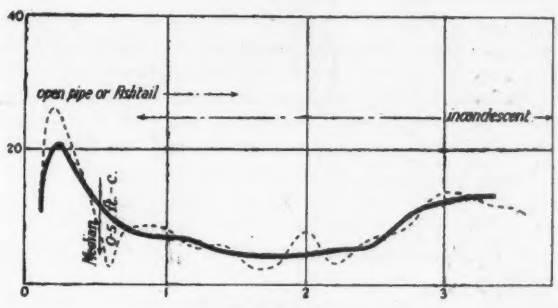
The tenement factories as a class undoubtedly present the worst types of factory lighting in Sheffield. With a few exceptions, they are buildings of old construction divided into numerous completely separate grinding hulls and workrooms. Each hull may contain from two to six troughs, one or more of which may be rented by each tenement occupier.

The lighting, supplied like the power by the proprietors, is for the most part still crude, even where electricity has been introduced imperfect use of appliances having been made. In the gas-lit tenements illuminations of one-tenth foot-candle have remained unchanged within the past fifty years. The men commonly complained of the inefficient lighting, but lack of co-operation prevented improvement. The tenement proprietor usually has little to gain from it monetarily, and the occupier can rarely face the expense of a single installation on premises of which he is merely the tenant.

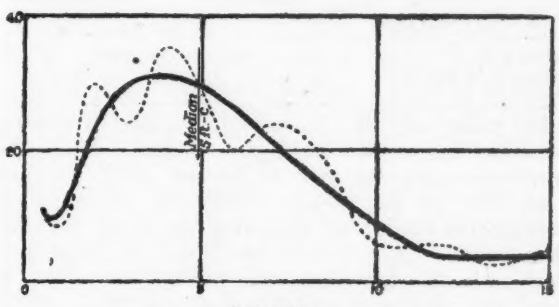
The charges, both for naked-flame gas illumination and for electric lighting, vary very widely. Imperfect use is made of the available gas lighting. It is true that in the grinding and some other processes vibration and flying sand, etc., make the use of local incandescent gas-fittings troublesome, and as a result the illumination of an open-ended gas-pipe or batswing burner is usual. Nevertheless, greater use can be made of incandescent fittings, as is evidenced from the action of some of the more enterprising workmen.



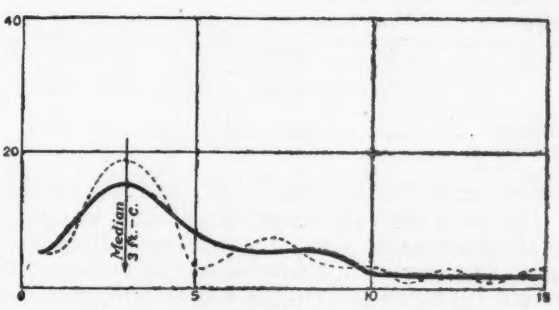
Foot-candles.
Fig. 1. Tenement factories : all classes.



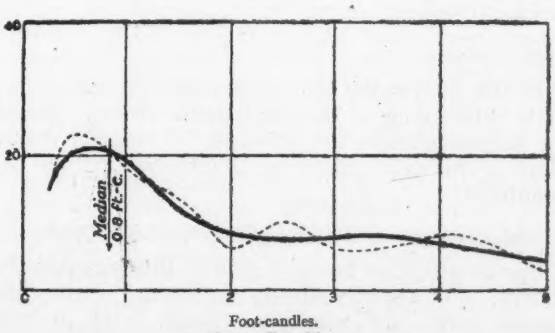
Foot-candles.
Fig. 2. Tenement factories : gas-lit only.



Foot-candles.
Fig. 3. Cutlery and silversmiths : buffing.



Foot-candles.
Fig. 4. Cutlery grinding ; employers' hulls.



Foot-candles.
Fig. 5. Foundries.

Frequency of Occurrence Curves

LIGHTING CONDITIONS IN TENEMENT FACTORIES

F.1762 No.	Charge per week	Intensities Min. (mean), max.	Glare Severity Figure (estimated)	Comments
Gas flare lit :—				
65	Included in rent	0·1 (0·6) 1·25	—	Higher values due bats-wing burners
66	9d./point	0·5 (0·8) 1·2	—	
68	6d./point	0·125 (0·29) 0·5	—	Higher values due two adjacent flares (1/6 per week)
75	Own meter each	—	—	
76	9d./point	0·3 (0·5) 0·7	—	do.
Incandescent gas lit :—				
66	9d./point	0·3 (2·6) 6	(0)–75–25–0	No globes or screening
68	6d./point	2 (2½) 3	(0)–75–25–0	do.
76	9d./point	1·75 (2·5) 3·25	(0)–100–0–0	Semi opal globes
Electrically lit :—				
69	4d./point	not available	(25)–50–25–0	100w. clear cause bad glare; obsolete bulbs local inadequacies
71	?	1·25 (3·8) 7·0	(0)–75–25–0	60 and 100w. pearls but no screening
72	9d./trough	0·5 (2·25) 5·5	(25)–50–25–0	
73	Own meter each (gas and electricity)	—	—	Pay own bills direct, and own maintenance (including meter rent)
74	Own meter each (gas and electricity)	—	—	
75	Own meter each (gas)	—	—	do.
76	9d./point	2·0 (2·5) 3·0	(0)–75–25–0	Mostly obsolete bulbs

Mean figures are as follows:—

Type of Lighting	Intensities min. (mean), max.	Glare Severity Figure
Gas flare lit	0·25 (0·55) 0·9	—
Incandescent gas lit ..	1·0 (2·4) 12·1	(0)–83–17–0
Electrically lit	1·25 (2·85) 5·13	(12½)–62½–25·0

In many of the electrically lighted tenement factories, lamps and fittings are supplied by the proprietors and are left to become dirty, old and worn out. In one case in which the grinding hulls were lighted exclusively by flaring gas points illuminations from 0·125–0·5 ft.-c. prevailed. A number of workers in this tenement undertook to make tests of their respective reductions in output in artificial light—an inevitable reduction for which they all allow when estimating times of delivery. From these data the following table has been prepared :—

Process	Output per hour		Reduction per cent.
	Full daylight	By gas jet	
Grinding	48	39	18·7
Whittening	51	42	17·5
Rough buffing ..	102	84	17·5
Finish „	90	60	33·3

The above figures represent men working continually on the processes enumerated in the table. Alternatively where two men each completed all the processes, the output fell by 20 per cent. Moreover, with good class work it becomes necessary to look over and touch up each morning the work completed by artificial light the night before.

Steel Tools, etc.

In this section the general standard of lighting is a little better than in the Silversmith's trade. Details for various sections are given in the original report. Here again wide variations in illumination are encountered.

Manufacturing and Testing of Safety Razor Blades.

Special attention has been paid to this important industry. For the exceedingly important testing processes, girls are specially chosen and trained. Inspection is usually carried on in small three-sided, open-fronted, wooden cabinets finished internally a dead black. Internal local lighting by 100-watt pearl, clear, or daylight lamps inreflectors is usually provided. The intensities derived from the local lighting are usually high, *e.g.*, in eight factories examined the minimum was 110 ft.-c., and maximum 325 ft.-c., and the average 211 ft.-c., though in other cases daylight bulbs yielding 90 ft.-c. were adopted.

The examination takes two forms. In the "Edge" test a number of blades are bunched together and the edges examined under a strong light. Any nicks or blunted or flattened edges, the result of imperfect grinding, appear as white specks or streaks on a dark background. In the "Flat" test the bunch of blades is turned over on to its face and fanned out (as playing cards are handled) so that unsymmetrically finished edges are detected. Evidently a strong reflected glare must emanate from the polished surfaces, especially where clear 100-watt bulbs from a 6 in. to 9 in. range are used. With a view to diminishing this drawback experiments with diffusing apparatus, *e.g.*, the placing of tracing linen across the bottoms of the reflectors, have been tried. This process naturally led to some diminution in illumination and to criticism that the lighting was insufficient. In one case a cabinet with a special diffusing roof was constructed, the cabinet being intersected at a height of 1 ft. 9 in. from the base by a tracing linen screen above which a 150-watt clear bulb lamp was placed. The floor of the cabinet was thus uniformly illuminated to 80 ft.-c. Some inspectors considered this insufficient, but they were accustomed to working in intensities of 200 ft.-c. Other experiments were made, the dual system of lighting enabling two different ranges of intensities, *i.e.*, a steady diffusing light of 25–55 ft.-c. which could be increased instantly by a foot switch from 80–150 ft.-c. It is evident from the differences of opinions recorded that much depends upon the conditions to which inspectors have become accustomed The following summary of observations on this point is presented in the report :—

> "Apparently the most successful of the arrangements noted is obtained from a 60-watt daylight bulb in a local intensive reflector. It should be at 9 in. above bench level and canted at 30 degrees to the vertical in a place parallel to the front elevation of the cabinet.
>
> "The near working illumination so obtained is about 60 ft.-c. with higher values at points of filament image. The resulting reflected glare was less by this means than by any noted elsewhere.
>
> "If inspectors are trained with this arrangement, they should be taught to use the filament image for test purposes on the bevelled edges, but to avoid, as much as possible, subjecting their vision to reflection from the face of the blades. In this way good results are obtained. If the work of an inspector is below standard or there are signs of strain or fatigue, 100-watt bulbs may be tried, but their use is not otherwise recommended."

Steelworking.

Under this heading various processes are dealt with. In blast furnaces, crucible steel melting, etc., general

lighting with occasional local points is usual. Platforms, fairways, working floors, etc., appear as a rule sufficiently lighted for safe walking. Alarm signals are given before commencing dangerous operations. A fine process is the examination of the faces of steel ingots, after grinding, for minute flaws or cracks. General illumination is usual and complaints of inadequate lighting rendering flaw-detection difficult and laborious are encountered. In one case the difficulty was overcome by placing two 100-watt bulbs in intensive reflectors so as to throw an inclined illumination in opposite directions on the billet. In steel forging, lighting conditions are only slightly better than those common in foundries ; even where adequate systems of lighting are provided, they are apt to be neglected and allowed to become coated with dust. The illumination from an excellent modern installation was in this way reduced to 66 per cent. Inadequacies are not so severely felt in heavy forging, but are detrimental where work is forged in drop stamps. In this process intensities down to 0·3 ft.-c. are common.

In rod, wire and rolling general lighting is invariably provided, though local points at the rolls are usual when rolling diameter is less than ½ in. ; alternatively, guides for the insertion of the rods or wiring are provided. High intensities of floor illumination are apparently best avoided, since the red-hot metal is more readily discernible at lower values. Experience suggests that floor lighting varying evenly from 3 ft.-c. at the rolls to 2 ft.-c. at all points more than 30 ft. distant meets the requirement. Danger must arise from strongly glaring sources at low levels and in proximity to the rolls.

Examination of Stainless Steel Strip.

In connection with this process, cases of nystagmus have been diagnosed as a result of which the firm in question installed an expenisve lighting scheme employing varicus daylight lamps. It was found, however, that in spite of the number and size of the units the illumination provided was only about 2½ ft.-c., and inspectors still complained of the unsatisfactory lighting. A conclusion was formed that trouble arose mainly from the " mirroring " of the point sources in the surfaces examined. The image of at least one lamp was always clearly visible. As an inspector moves along the strip the eye instinctively seeks and follows the bright images and observation of the surfaces involves a continuous effort to force the eyes away from them on to a seemingly different plane. From these considerations it was judged that any form of spaced sources is unsuitable and that images should be eliminated by the adoption of conditions resembling those characteristic of an evenly illuminated ceiling. A suitable form of diffusing unit was accordingly suggested consisting of a wooden frame 10 ft. by 3 ft., covered with tracing linen and fixed horizontally at 4 ft. above the bench. At 2½ ft. above it were two existing 300-watt clear lamps in metallic reflectors at 5 ft. centres. The resulting illumination varied from 24 ft.-c. under each lamp to 15 ft.-c. at the centre-point between them. The screen was plainly mirrored in the polished steel sheet, but the large diffusing area was considered a great improvement. Subsequently, completely boxed-in portable units, about 10 ft. long and embodying 100 watt lamps at 1 ft. centres above the linen screen (the woodwork adjacent to the lamps being enamelled white internally), were decided upon. It is hoped that a permanent installation of this kind will be completed by next winter. Several other firms have recently taken up this process and if the above installation proves successful its adoption may be recommended.

Foundries.

Of 21 foundries visited, 19 were lit electrically, one by incandescent gas, and one by flaring gas jets. Lumeter readings were taken in 15 of them, of which 23 per cent. were less than 0·5 ft.-c., 52 per cent. less than 1·0 ft.-c., 71 per cent. less than 2·0 ft.-c., and only 10·5 per cent. in excess of 5 ft.-c.

An erroneous theory that good lighting is not needed in foundries is still strongly fixed in employers' minds. Individual foundrymen however will, when questioned, complain of inadequate lighting conditions which give rise to difficulty in seeing clearly the outlines of the dark sand. Moreover, fragments of sand, falling into the moulds, are apt to be overlooked and subsequently spoil the even surface of the casting. In only five of the foundries was insufficient power consumption the cause of inadequacy. In seven of them the sources seemed to be of ample power but were of unsuitable heights, or the fittings or lamps were unsuitable or worn out, and in three more cases general dirtiness increased this reduction. In one case the foundry floor illumination by expensive modern units was increased from 7 to 12 ft.-c. merely by a quick dusting only. In smaller foundries clear lamps entirely unscreened or in shallow conical reflectors are still commonly used at 8 ft. level, giving rise to severe glare. Oblique lighting from 12 ft. to 15 ft. above floor level was noted in a few cases. In view, however, of the tendency to glare at certain points and the production of shadows in the hollows of the moulds, it does not seem to be so successful as overhead direct lighting.

Many of the foundries in the area surveyed are exceedingly old. One, it is stated, dates back to the seventeenth century. (Its appearance largely supporting this claim !) Here, as in several others, the natural lighting is so limited that artificial lighting is continuously used during working hours. In the concluding section dealing with heavy engineering, it is remarked that in the larger shops reasonably good systems of general lighting were usually found. Here, too, however, many installations have been allowed to deteriorate during the present depression.

The Lighting of Docks, Warehouses and their Approaches

A useful report on the above subject by Mr. J. S. Preston (Illumination Research Technical Paper, No. 14) has been issued by the Department of Scientific and Industrial Research. After an introductory explanation of principles typical installations are described, and various special problems (such as the treatment of road and rail approaches, dock entrance locks, quays, warehouses, granaries and special installations, and the use of additional working lights) are discussed. Throughout the report attention is drawn to the valuable part played by judicious contrast (such as is afforded by the whitening of quay edges) and the dangers of excessive contrast, as exemplified in glare. The explanations are illustrated by photographs of actual installations, some of which show clearly the operation of the contrast-effects referred to above, and by polar curves of lighting installations. In an Appendix recommendations issued by various authorities on values of illumination for industrial processes are summarized.

Literature on Lighting

(Abstracts of recent articles on Illumination and Photometry in the Technical Press)

Abstracts are classified under the following headings: I, Radiation and General Physics; II, Photometry; III, Sources of Light; IV, Lighting Equipment; V, Applications of Light; VI, Miscellaneous. The following, whose initials appear under the items for which they were responsible, have already assisted in the compilation of abstracts: Miss E. S. Barclay-Smith, Mr. W. Barnett, Mr. S. S. Beggs, Mr. F. J. C. Brookes, Mr. H. Buckley, Mr. L. J. Collier, Mr. H. M. Cotterill, Mr. J. S. Dow, Mr. J. Eck, Dr. S. English, Dr. T. H. Harrison, Mr. C. A. Morton, Mr. G. S. Robinson, Mr. W. R. Stevens, Mr. J. M. Waldram, Mr. W. C. M. Whittle, and Mr. G. H. Wilson. Abstracts cover the month preceding the date of publication. When desired by readers we will gladly endeavour to obtain copies of journals containing any articles abstracted and will supply them at cost.—ED.

(*Continued from p.* 195, *August*, 1933.)

II.—PHOTOMETRY.

233. The Primary Standard of Light. J. W. T. Walsh.

World Power, 20, *pp.* 68-70, *August*, 1933.

The work done in the development of a primary standard of light is summarized, and the use of a black-body as a primary standard of light is discussed. C. A. M.

234. Photometer Developments. Anon.

El. Review, *CXII*, *No.* 2,900, *p.* 908, *June* 23rd, 1933.

Describes and illustrates a commercial cubical integrator with a bench photometer. The design is conventional. J. M. W.

235. Integrating Photometers. Anon.

Elect., 111, *pp.* 117-118, *July* 28*th*, 1933.

Descriptions are given with photographs and diagrams of recent developments in small integrating photometers. A visual integrating cube is described in detail, together with a photo-electric type in which the measuring instrument is connected in series with the photo-cell. Sources of error are touched upon. A modification in the construction to allow for rapid interchange of lamps is shown. A special cubical integrator, of 1 ft. side, is designed to be portable, and has attached a combined voltmeter and wattmeter, and also a direct-reading lumen-meter connected to the photo-cell. C. A. M.

III.—SOURCES OF LIGHT.

236. Investigation of Incandescent Lamps for the Purpose of Increasing their Illuminating Power. H. Bertling.

Licht u. Lampe, 22, *No.* 13, *p.* 332, 1933; *and No.* 14, *p.* 351, 1933.

It has been determined that the life of the lamp depends on local thermal overloading due in vacuum lamps to the rebounding of the electrons emitted and the resulting ions. Electrodes giving a negatively biased field will nullify the effect of the electrons by bringing the whole filament up to the temperature of the hitherto overloaded sections, and thus increasing the light output. With gas-filled lamps rapid local recrystallization at the supports and the negative end of the filament, due to the Thomson effect, can be avoided by heat-insulated supports. The use of metals which, when heated, absorb H_2 will give a permanent getter effect. E. S. B-S.

237. Small Incandescent Lamp.

Electric Journal, *January*, 1933.

A 2½-watt 115-volt lamp, stated to have a filament 0.0003 in. diameter, or one-tenth of a human hair, is described. The lamp is intended for special purposes, such as the illumination of house number-signs, clocks, etc. J. E.

238. Mechanical Base. H. G. Schiller.

Light, 2, *No.* 13, *pp.* 30-31, *Summer*, 1933.

A new method of securing the lamp cap to the bulb without the use of cement is described. C. A. M.

239. A New Development in Hot-Cathode Discharge Tubes. Anon.

World Power, 20, *p.* 67, *August*, 1933.

A brief description with diagram is given of the new Mazda-Mercra hot-cathode discharge lamp. C. A. M.

240. Discharge-tube Lighting. J. T. Randall.

Elect., 111, *p.* 44, *July* 14*th*, 1933.

A description is given of various physical features of luminous discharge tubes, together with particulars of recent developments in hot-cathode tubes. C. A. M.

241. Improved Projection Lamps. F. E. Carlson.

Light, 2, *No.* 13, *pp.* 8-9, *Summer*, 1933.

Various improvements in the manufacture of American grid-filament projection lamps are described, with photographs. In the range shown the average rated life is, in some cases, as low as 25 hours. C. A. M.

242. Infra-red. H. G. Schiller.

Light, 2, *No.* 13, *pp.* 29-30, *Summer*, 1933.

Two sizes of incandescent tungsten-filament lamps are now available in America as sources of infra-red radiation. A photograph shows various types of fittings in which they can be used. C. A. M.

IV.—LIGHTING EQUIPMENT.

243. Scientifically-designed Lighting Fittings. Anon.

El. Times, 84, *p.* 67, *July* 13*th*, 1933.

A short account of a new totally-enclosed fitting, said to have several excellent features. In particular, the even distribution of illumination makes possible a greater spacing than usual. Two photographs are given. W. R. S.

244. The Importance of Fittings. Design in Relation to Factory Illumination. R. O. Ackerley.

World Power, 20, *pp.* 77-79, *August*, 1933.

The importance of the correct design of fittings intended for factory illumination is discussed. Particular reference is made to the desirability of uniformity of illumination values over the working plane. C. A. M.

V.—APPLICATIONS OF LIGHT.

245. Recommendations of the D.B.G. for Daylight Illumination.

Licht u. Lampe, 22, *No.* 15, *p.* 375, 1933.

Recommendations for the minimum "daylight quotient" or the ratio of the light intensity at a certain point in a room to the horizontal light intensity prevailing at the same time in the open are given for coarse, medium fine, fine and very fine work. E. S. B-S.

246. The New Docks at Southampton. Anon.

El. Review, CXIII, No. 2,906, *p.* 155, *August 4th*, 1933; also *Elect.*, *p.* 87, *July 21st*, 1933.

The lighting of the new dock sheds at Southampton is carried out by means of specially designed silvered-glass reflectors with 500-watt lamps, spaced at 45 ft. and mounted at 19 ft. from the ground. An increase of 50 per cent. in illumination, as compared with the old installation, has been secured, with a decrease in energy-consumption of 36 per cent. J. M. W.

247. The Lighting of Railway Yards and Sidings. J. G. Christopher.

World Power, 20, *pp.* 71-76, *August*, 1933.

The various methods of lighting railway yards are discussed. The system adopted in America, and to some extent on the Continent, is the use of a battery of floodlights on towers from 70 ft. to 110 ft. high. In this country it is more usual to mount individual units on poles 30 ft. to 40 ft. The requirements, both optical and mechanical, of floodlights for such work are dealt with in detail. Photographs are given. C. A. M.

248. "The Queen City's Regal Terminal." J. L. Tugman.

Light, 2, *No.* 13, *pp.* 12-14, *Summer*, 1933.

A description is given, with numerous photographs, of the lighting equipment of the new railroad terminal at Cincinnati. The mural decorations employed have received particular attention. C. A. M.

249. On the Coloured Signals of Marine Beacons. André Blondel.

R.G.E., 34, *pp.* 3-13, *July 8th*, 1933.

This article is the reprint of a paper presented by M. Blondel before the International Conference of Marine Signalling at Paris in June, 1933. The author advocates standardization of marine signals and beacons, and puts forward methods of obtaining this end. The considerations can also be extended to include other types of beacon. W. C. M. W.

250. Osira Lighting at Lewisham. Anon.

El. Times, 84, *p.* 178, *August 10th*, 1933.

An account is given with a photograph of Park Street, Lewisham, which is now lit with "Osira" gaseous-discharge lamps. Glass is stated to be almost totally absent owing to the particular type of lanterns employed. W. R. S.

251. Worthing Street Lighting. Anon.

El. Review, CXIII, No. 2,907, *p.* 197, *August 11th*, 1933.

A brief description of the street-lighting installations used in the less important streets in Worthing, employing 200-watt lamps and directive reflectors. J. M. W.

252. The Lighting of The Masonic Peace Memorial Building. Anon.

El. Review, CXIII, No. 2,905, *pp.* 111 *and* 122, *July 28th*, 1933.

The illumination of the Masonic Peace Memorial building has been most carefully designed to harmonize with the architectural design. Elaborate and ingenious devices have been employed. Some of these are described and illustrated. J. M. W.

253. Lighting for the Small Stage. C. M. Cutler.

Light, 2, *No.* 13, *pp.* 19-22, *Summer*, 1933.

The problem of lighting a small stage for amateur productions is discussed. Diagrams showing details and lay-out of equipment are given. C. A. M.

254. Wrigley Building Floodlighted Ten Times Former Intensity. Anon.

El. World, 102, *p.* 105, *July 22nd*, 1933.

The insensity of the floodlighting of the Wrigley Building at Chicago has recently been increased from a maximum of 15 foot-candles to a maximum of 130 foot-candles. Figures are quoted for the increased cost of the installation and for the increase in power consumption. W. C. M. W.

255. Lighted House Plants Offer Profitable New Field. Anon.

El. World, 102, *p.* 105, *July 22nd*, 1933.

Tests on the lighting of plants in houses, made by Messrs. Porter and Prideaux, of the General Electric Company, are described. It is felt that opportunities of increasing sales of lighting equipment are thus presented. W. C. M.W.

VI.—MISCELLANEOUS.

256. The Human Seeing-machine. M. Luckiesh and Frank K. Moss.

Frank. Inst. J., 215, *pp.* 629-654, *June*, 1933.

The article deals with "seeing," a term used to include psycho-physiological as well as physical response in the performance of visual tasks. Reference is made to the numerous factors influencing efficiency of effort, and to the various types of measurements that can be made. Finally, some suggestions are made for improving seeing conditions. S. S. B.

257. Reflex Theory of Glare. E. L. Elliott.

El. World, 102, *p.* 126, *July 22nd*, 1933.

The reflex theory of glare put forward by Professor Allen is briefly discussed. Reference is made to the quality of the light which affects the eye. W. C. M. W.

The Lighting of the Masonic Peace Memorial

By courtesy of *Electrical Industries and Investments.*

Top Left: Louvred Fitting for dome lighting (Lodge Room No. 6).

Bottom Left: Lunette Lighting (also in Lodge Room No. 6).

Top Right: Typical Pendant Fitting (Second Vestibule).

Bottom Right: Onyx Panel and Illuminated Windows (Grand Temple).

Centre: Standard carrying Indirect Bowl Fittings (Vestibule).

THE lighting of the Masonic Peace Memorial, which now stands at the junction of Great Queen Street, Drury Lane and Long Acre, London, presents some very notable and unusual features. This new central headquarters of English Freemasonry, which was dedicated on July 19th, is a memorial to Freemasons who fell in the Great War, and is a magnificent building. The architecture presents many novel features and design, and exceptional care has been devoted to the lighting by one of the leading members of the Illuminating Engineering Society, Mr. A. W. Beuttell, who acted as consulting illuminating engineer. His co-operation with the architects (Messrs. H. V. Ashley and Winton Newman) and the consulting electrical engineers (Messrs. Burstall and Monkhouse) has been attended with happy results.

On entering this building one at once receives an impression of spaciousness with which the pendant fittings (frequently cylindrical in design, as shown in one example above) are in keeping. Throughout the entire building the use of diffusing glass gives rise to a soft and pleasing effect, which is enhanced by the effect of the numerous coloured windows, furnished with blinds and artificial light so as to be revealed equally well by night and by day.

The Grand Temple.

The most impressive of all the rooms is naturally the Grand Temple, in which architecture, lighting and decoration are skilfully blended to convey an impression of the dignity and antiquity of the Craft, yet to present it in a new setting—all being on modern and highly original lines.

The main features of the lighting are that there are no visible luminous sources, and there is no daylight.

The temple is lined with Botticino (light) marble, with Ashburton (dark) as a base, and is arranged with a large recess for the dais in the east, and smaller recesses, each containing a balcony to the south, west and north. The height from floor level to the ceilings of these recesses is 37 ft. Connecting adjacent recesses are four splayed walls, each with a doorway, and between all of these the main

portion of the chamber rises to a cove of 11 ft. radius and thence to a ceiling 60 ft. above the floor at its centre.

The ceiling is coffered and richly decorated in colour; the inner portion is of dark blue silk, representing a night sky studded with gold stars and carrying at its centre a large luminous star with sixteen points.

Below the cove, which is rendered in delicate mosaics, is the great cornice containing the principal source of concealed lighting. The function of this lighting is to provide a general illumination via the ceiling, whilst limiting nevertheless the intensity of direct light upon the mosaics of the cove to that of an illuminated picture. The desired effect has been successfully obtained by using standard 100-watt concentrating units at 1-ft. centres and masked from cove to project to the ceiling and trough reflectors using only 60 watts per foot-run for illuminating the mosaic cove.

An interesting feature of the ceiling equipment is a fibrous plaster grid based on the Greek key, which surrounds the central portion. It serves as a ventilating grid, and is surrounded by a casing extending upwards into the roof above. The casing comprises an optical system by which a row of concentrating units at the top projects the light downwards through the grid. The light undergoes several processes. Firstly, it is refracted longitudinally so as to form a continuous beam. Secondly, it is louvred so that its full intensity operates only within 15° of the vertical. Thirdly, it is slightly diffused so as to confuse the pattern of the louvres above, and, fourthly, it passes through the ventilating duct to the chamber underneath.

The effect from below when viewed from any angle greater than 15° is to provide a softly diffused background for the grid, which appears in silhouette, while by its direct intensity it can be used to increase substantially the horizontal illumination on the working plane.

From the ceiling comparatively little light penetrates to the remote portions of the dais and the balcony recesses. Over the dais the architects have provided a threefold laylight through which pours, as from the sun, a powerful golden light illuminating this important area to a level of intensity noticeable above that of the rest of the interior. The underside of the ceiling is dealt with by two imposing bronze standards carrying indirect bowls on either side of the organ console.

In every recess at the over-balcony level are three horizontal illuminated windows. Once more the golden light streams as it were from the shining sun without, whilst under the balconies on each side, north and south, are three vertical stained-glass windows, rich in the dark blue and gold of Freemasonry, similarly illuminated. In each case the lighting units are concealed below the sill so as to perform the double function of illumination of the outer window, which serves as an illuminated screen and background, and to throw sufficient light on to the balcony ceiling to take it out of shadow.

There remains only to describe the means of providing downward light at the back of the balcony recesses. For this purpose ceiling panels running adjacent and parallel to the windows have been fitted with onyx (transparent) marble in place of the Botticino, illuminated from recesses above. The effect is that of a rather deeper gold than from the windows and laylights. The light not only illuminates these remoter areas, but streams down the curtains which cover the outer walls, and the panels serve also to mark the boundaries of the chamber and to avoid that shrinking of the interior which can so easily take place if the boundaries are inadequately lit.

The total lighting load of the Grand Temple is 72·5 kw., giving 4 foot-candles in the main area, and 6.5 foot-candles on the dais.

The dais laylights only are on dimmers, and on the occasion of the dedication ceremony these and certain combinations of progressive switching were most effective in the leading up to the opening stages of the ceremony.

Lodge Rooms.

Lodge Room No. 6.

This Lodge, which is outstanding in its architecture, is designed in the plan as an elongated rectangle, with a recess at each side. In ceiling plan, it comprises a large dome at the centre; pendentives below leading to a square, on each side of the square a wide arch or barrel, filling the side recesses, and towards each end terminating as an apse. Beyond each corner of the central square is a small pillared square surmounted by a small dome.

The architecture obviously did not permit of pendant fittings. There is no cornice, either on the walls or round the base of the great dome. The architecture had, however, provided a hole 6 ft. in diameter at the apex of the latter.

It was decided to illuminate the lodge indirectly by projecting light through 24 lunettes in the upper walls on to the arches and ceilings of the apses. So far as the central dome was concerned, it was to be illuminated from above, but so that no direct or transmitted light should reach the lodge below or any portion but the surface of the dome itself.

In the result the 6-ft. opening above the dome was closed by a fitting consisting of a series of concentric louvres. Twelve 500-watt projectors were placed above it in a circle and the light projected through the louvres on to the dome. The latter is perfectly illuminated to its base, and no light passes or is visible from beyond. The underneath sides of the louvres, which are in sheet metal, were finished artistically and shaped at their outer edges to merge in the scheme of decoration. The general effect is pleasing. Surface brightnesses are neither so low that the fitting appears opaque, nor so high that it would seem to be translucent. Whilst performing its function and transmitting ample light, it gives the impression of a weightless, illuminated ornament belonging to the decorative equipment.

The lunette units in the wall recesses were designed as ellipsoidal reflectors with their secondary foci on upturned axes and nearly coinciding with the centres of the opening so as to ensure the maximum of the light being concentrated through the small circular openings.

Louvres were fitted to reduce the brightness of the dished, hammered lunette glasses to a comfortable level, the glasses being lined with heat-resisting glass, and the whole, as well as other units in this room, corrected towards daylight quality, so as to preserve the colouring of the decoration. The general effect is restrained but agreeable, giving an impression of "coolness" so marked as to suggest an actual lower temperature than that in adjacent rooms.

The description given above covers those features of the lighting equipment of the building which are the most interesting from their technical standpoint. The numerous other lodges, the Grand Master's and Grand Officers' suites, the Museum, Library, and other parts of the building are all treated in a different and distinctive manner. The chief concern of the architects has been to show that modern

methods of lighting can be used without sacrificing anything of the classic convention, a feature throughout being the adoption of surface brightness so as to ensure an effect that is glareless.

The illumination provided in the Grand Temple is about 4 foot-candles in the body of the interior and 6½ foot-candles on the dais. Throughout the lodges a standard of approximately 4 foot-candles was also aimed at. In the case of such unusual installations as these, in which indirect lighting effects are combined with the transmission of light through diffusing materials, the predetermination of illumination is naturally a matter of some difficulty. This applies more especially to the somewhat complex methods adopted in the Grand Temple and in Lodge Room No. 6. We understand, however, that the actual illumination proved to approach quite close to the estimated value—which was based purely on calculation and without such aids as the use of models. It is interesting to observe that although the shape and design of the fittings in the lodge rooms varied so greatly, each room being given a distinctive mode of lighting, the installations had certain good features in common, e.g., the illumination throughout was maintained at about 4 foot-candles, and the brightness of the luminous surfaces was confined within moderate limits and was substantially even. This latter characteristic—the absence of unsightly patches of light—was also noted in the numerous examples of artificial lighting of windows bearing coloured designs.

Careful consideration was given to the glassware to be used in the fittings so as to avoid the glare of bright spots and maintain the minimum brightness of panels as high as possible.

In nearly all cases the illuminating engineer selected and specified single flashed opal, which was used in various tints. Interest and brilliance were effectively added to its otherwise somewhat flat appearance by cutting or sandblasting through the flashing. We understand that as a result of its wide adoption in this building the manufacture of this glass was undertaken by a leading glass manufacturer and is now available in its full range as a British product.

The following firms supplied equipment for the indirect lighting of the Grand Temple and Lodge Room No. 6, to the design of the consulting illuminating engineer:—

Grand Temple: Benjamin Electric Co. Ltd. (trough reflectors for cove); Edison & Swan Electric Co. (illuminated windows); General Electric Co. Ltd. (concentrating units); Holophane Ltd. (dais laylights); Ingram & Kemp (central star). Decorative design of indirect standards and wall brackets by Mr. Walter Gilbert, who also designed and carried out many other fittings in the building.

Lodge No. 6: Troughton & Young (lunettes and central dome fittings and small semi-indirect pendants); Edison Swan Electric Co. Ltd. (illuminated windows); E. Heffer & Co. (decorative design of indirect standards).

In addition to the above the following firms also supplied fittings: Best & Lloyd Ltd.; Birmingham Guild Ltd.; F. T. Cash; Dernier & Hamlyn; Galsworthy Ltd.; Higgins & Griffiths; K. & M. Ltd. (electric signs); Osler & Faraday Ltd.; Pringle Art Metal Co.; F. H. Pride; Woodfyt Sales Ltd.

[We are indebted to the courtesy of *Electrical Industries and Investments* for the illustration appearing under the title of this article.]

Some Notes on the Advertising Exhibition at Olympia

At the Advertising Exhibition, the first of its kind, in London, there were quite a number of exhibits that were associated with lighting. Throughout the exhibition light, from a variety of sources, was consistently and on the whole skilfully applied. In spite of the high standard of illumination, glare was in general avoided. The prevalence of hot weather during the period of July 17th to 22nd, however, enforced on the attention of some exhibitors the considerable amount of heat radiated from the incandescent filament.

In the main thoroughfare two tall columns of straight neon tubes erected round spirals of contrasting coloured gasfilled lamps gave impressiveness to the approach to the Hall of Service, through which one reached the Advertisers' House. Here one device, on which the Prince of Wales commented, was a bookholder which gives comfortable reading everywhere and works either from mains or accumulator. The use of neon tubes in a novel manner was demonstrated by a series of varicoloured concentric circles flashing alternately at a high rate of speed producing the illusion of a band of colour alternately expanding and contracting. The uncertainty as to the order in which the colours will appear adds to the attractiveness of this ever-moving device. A flaming arrow darting backwards and forwards, one hundred and eighty times a minute, was again a striking feature for use with certain advertisements. Interchangeable, high luminosity unit letters, in sizes up to 18 ins., capable of being assembled with rapidity to build up any desired luminous announcement, formed another feature of this exhibit.

One large exhibit, consisting of various assemblies of perpetually blinking neon-filled, star-like lamps, naturally attracted much attention. This interesting and economic device is in itself a truly wonderful piece of mechanical construction, which by its perfection ensures a reliable rapid twinkling of the light emission, whether connected to direct or alternating-current mains. The extinction of the lamp is the result of the reaction of the lighting on the controlling circuit, and no external flasher is needed. The only essential precaution is to avoid the use of lamps constructed for direct-current circuit on alternating supplies and vice versa. The price of these lamps was stated to be but little in excess of ordinary glow lamps and the period of life substantially the same. Whether lamps are used individually or in groups, the animated effect is very attractive.

Sky-writing by means of a very powerful arc-lamp, with a beam rated by Professor Pollard at over 5,000 million candle-power, concentrated by a mirror of special design, was another novelty. A series of pictures, shrouded in a large container but brought periodically into view, was shown, in "still life," and was also revealed in active operation in Whitehall above the theatre there, a convenient situation since, when no clouds are available, pictures may be projected on to an adjacent wall. In other situations an anchored balloon would serve as an adequate background. The apparatus exhibited is mobile, and can be used anywhere and on any occasion for announcements of up to 100 letters at a time.

Among the varied types of illuminated signs shown interest attaches to a new pattern consisting of neon tubes, recessed into a groove in the glass, thus causing light to pass through the glass laterally, and vividly illuminate any design sandblasted on its surface.

J. E.

"—use only"

Director: "What *is* the matter with our electric light these days? We seem to have less light and to pay more for current than ever before."

Manager: "I'm afraid we made the mistake of installing 'cheap' lamps at the beginning of the winter. They lose light very quickly and replacements have been unduly heavy. We shall not make the same mistake again, but in future will use only

MAZDA LAMPS

WITH THE WONDERFUL NON-SAG FILAMENT.

3447 A

MADE IN ENGLAND ENTIRELY FROM BRITISH MATERIALS.

THE BRITISH THOMSON-HOUSTON COMPANY, LTD.

The Reorganization of Manor House Hotel, Leamington

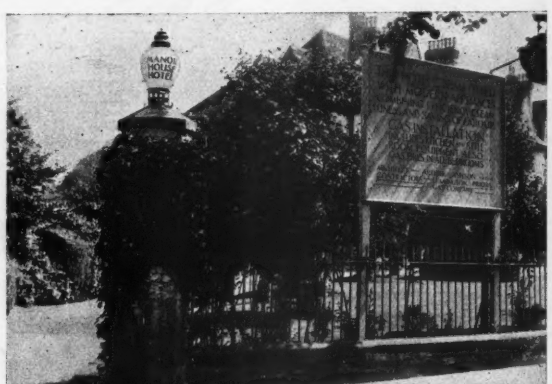
The recent reorganization of the above hotel should be of interest to many of those associated with the gas industry who are accustomed to make Leamington their headquarters when visiting the British Industries Fair at Castle Bromwich. This hotel was taken over last winter by a new company who have adopted gas for cooking and for the warming of bedrooms—most of these fires being of the "Sunbeam" type simulating the appearance of glowing coal.

For lighting the entrance gateways four of Hailwood & Ackroyd's lettered globe lamps, each with a Sugg's superheater burner with four Bijou inverted mantles and Horstmann controller at the back of the gate pillar, have been installed. One of these lanterns is seen in the adjacent illustration. This also shows a temporary notice, which at night-time is floodlighted by gas.

We are indebted to Mr. R. S. Ramsden, general manager and engineer of the Leamington Priors Gas Company, for the above particulars.

The Lighting of the Municipal Gallery of Modern Art, Dublin

We are asked to state that the design of the artificial lighting of the Gallery mentioned above, described in our last issue (pages 196-197) was carried out in collaboration with the Lighting Service Bureau of the Electricity Supply Board and Messrs. Holophane Ltd., London.



Gateway of Manor House Hotel, Leamington, showing gas lamps with name of hotel.

Association of Public Lighting Engineers

MEETING PLACE IN MARGATE.

By the time these words appear those participating in the tenth Annual Conference of the Association in Margate will doubtless have received their final programmes. We are asked to draw attention to one important change indicated therein. All meetings will take place, not at the Queen's Highcliffe Hotel, but at the Cliftonville Hall, St. Paul's Road, which is about five minutes' walk from the hotel.

A Night View of Enfield Council's Open-air Swimming-Pool.

The Floodlighting by Gas of an Open-Air Swimming-Bath

During the recent hot weather when the resources of swimming-pools were apt to be overtaxed those furnished with floodlighting, enabling bathing to take place in the evening, were at a great advantage. Many open swimming-pools have thus been treated. A good instance of floodlighting with gas is afforded by the Enfield Council's open-air swimming-pool, illustrated above. This pool is 200 ft. long and 80 ft. wide, and is illuminated by 12 "Kempar" 6,000-candle-power low-pressure gas lamps on 10-ft. 6in. "Snowcrete" columns, each lamp being separately controlled by a special form of distance-control device. The illumination of the water is highly effective. Not only is the light evenly distributed over the surface of the water, but the bottom of the bath can be clearly distinguished even in its deepest part.

In addition to the floodlighting of the pool, general lighting of the whole arena by eight 1,000-candle-power low-pressure gas lamps mounted on 14-ft. 6-in. "Snowcrete" columns has been provided. Throughout the arena it is possible to read small-print news with ease, and the illumination of the dressing boxes on the first floor is so good as to render special arrangements for internal lighting unnecessary.

The Tottenham and District Gas Company commenced the work of the installation on August 1st, and, by making special efforts, was able to complete the whole of the installation (for which about 1,000 feet of piping was used and 20 columns and lamps erected) in time for lighting up on the evening of August 5th.

We understand that general satisfaction with the results of their efforts has been expressed.

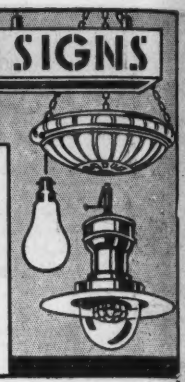
Visual Acuity under Sodium Light

The ability to distinguish fine detail, supplementary to contrast and other factors necessary for vision, is recognized as the criterion by which visual acuity should be gauged. It has long been believed that monochromatic light is superior to polychromatic light in this respect. Yet, according to Dr. M. Luckiesh, this is only so with certain wavelengths; the middle region of the visible spectrum is greatly superior to the extremities in this respect.

Practical investigation by him over a range of intensity from 5 up to 25 foot-candles showed no appreciable difference in the degree of visual acuity. The mercury-vapour arc is actually far from monochromatic, containing rays from the violet, blue, green, and yellow areas of the spectrum. When this source is subjected to filtration the visibility at certain wavelengths, tested at the same intensity of illumination, shows improvement. But when the shorter rays have been thus eliminated, the cost of production of light becomes uneconomical.

The emission from the sodium lamp is, however, approximately monochromatic, and at intensities, on a white surface, of 0.02 up to 20 foot-candles, distinctly better visual acuity than that attainable at the same illuminations with tungsten-filament lamps was recorded. How this will work out in practice cannot yet be assessed. In some circumstances the use of this form of light would diminish contrasts, but in some case contrasts would be magnified. Furthermore, the influence on visual acuity of conditions characteristic of high and low intensities of illumination must be properly appraised. Doubtless, owing to the Purkinje effect, sources rich in green light would be at an advantage when illuminations are very weak. The effect, however, depends on the angle subtended at the eye by the surfaces illuminated and on the area of the retina used—a circumstance that adds to the difficulties of heterochromatic photometry.

WHERE TO BUY
A DIRECTORY OF LIGHTING EQUIPMENT



We invite applications for spaces in this new section of the journal. Particulars of terms for each space (approx. 1 inch deep and 3¼ inches wide) are given below.

These terms are equivalent to **half our ordinary advertising rates**, but not less than 12 successive monthly insertions can be accepted on this basis, and amounts are payable in advance.

Payment for an advertisement in this section entitles the advertiser to receive *The Illuminating Engineer* during the period of the contract.

Terms :	**12**	**Successive Monthly Insertions**	**£3 10 0**	Payable
	24	,, ,, ,,	**£6 0 0**	in
	36	,, ,, ,,	**£8 10 0**	Advance

(1)

MODERN LIGHTING FITTINGS

New Catalogue on application

Fittings manufactured to Architects' Specifications

ASCOG LIMITED

Ascog House, 44, Theobalds Road, LONDON, W.C.1

(2)

PHOTOMETERS

ALEXANDER WRIGHT & CO., LTD.,

1, Westminster Palace Gardens, Artillery Row, Victoria Street, LONDON, S.W.1.

(3)

ALLOM BROTHERS LTD.

16, GROSVENOR PLACE, LONDON, S.W.1

Specialists in the Science of Modern Lighting, including :—

Theatres and Public Halls. Tennis and Racquet Courts.
Pictures and Picture Galleries. Floodlighting, etc.
Decorative Fittings in Glass and Metal.

(4)

You get the benefit of over twenty years' world-wide experience in the science of Commercial and Industrial Illumination when you specify lighting planned by

BENJAMIN

The Benjamin Electric Ltd., Tottenham, N.17

(5)

"LINOLITE" STRIP REFLECTORS

For showcase, shopwindows, cornice, facia, architectural lighting, etc.

Sole Manufacturers :—

A. W. BEUTTELL LTD.

96, VICTORIA ST., LONDON, S.W.1

(6)

BROMFORD

Seamless Steel Lighting Standards.
Traffic Signals. Guard Pillars

for all requirements

BROMFORD TUBE CO., LTD., ASTON, BIRMINGHAM

(7)

REINFORCED CONCRETE LAMP COLUMNS

CONCRETE UTILITIES, Ltd.

WARE, Herts.

(8)

Specialists in

ARCHITECTURAL ILLUMINATION AND DESIGNS

DRAKE & GORHAM LTD.

36, GROSVENOR GARDENS, LONDON, S.W.1

Manchester, Glasgow, Exeter, and Winchester

(9)

ELECTRICITY SERVICES LTD.

Electrical Engineers

Sole Proprietors and Patentees of

THE "TYPERLITE" ADJUSTABLE LOCAL LIGHTING UNITS

Write for Price Lists : **86, CANNON ST., LONDON, E.C.4**

(Mansion House 5294 3 lines)

Engineering & Lighting Equipment Co. Ltd. (10)

SPHERE WORKS, St. Albans, Herts.

Manufacturers of :—

Street and Industrial Lighting Fittings and Equipment.

Specialists for over 30 years. Send for new Cat. No. 12.

(11)

"ESLA"

BI-MULTI AND MULTIPLANE REFLECTORS

Lanterns, Brackets, Columns, Switch and Fuse Boxes etc., **FOR STREET LIGHTING**

The Electric Street Lighting Apparatus Co.
The Foundry, Canterbury

(12)

Controlled Diffusion and Distribution of Light for Industrial and Architectural Illumination

G.V.D. ILLUMINATORS

Aldwych House, LONDON, W.C.2.

Laylights, Cornice and Pillar Lighting. Pendant Fittings and Standards (Direct and Indirect)

(13)

HAILWOOD & ACKROYD LTD.

BEACON WORKS, MORLEY, Near LEEDS

Sole makers of "HAILWARE" British-made Illuminating Glassware and Fittings, Traffic Globes and Signs, Island Columns and Footlights.

Offices and Showrooms at :—

71/75, New Oxford St., London, W.C.1. 314a, St. Vincent St., Glasgow
Carlton House, 28, High Street, Birmingham

(14)

Specify

HOLOPHANE

(Scientific Illumination)

ELVERTON ST., LONDON, S.W.

for

STREET CINEMA — CHURCH FLOOD — INDUSTRIAL SCHOOL, Etc.

(15)

KANDEM ELECTRICAL LTD.

(Late KORTING & MATHIESEN ELECTRICAL LTD.)
711 and 715, FULHAM ROAD, LONDON, S.W.6

Scientifically designed Incandescent Lighting Equipment for
CHURCHES, SCHOOLS, FACTORIES, STORES, STREETS, FILM AND PHOTOGRAPHIC STUDIOS.

Modern Arc Lamps for Street Lighting. Silent Arcs for Film and Photographic Studios.

(16)

RADIOVISOR PARENT LTD.

28, LITTLE RUSSELL STREET, LONDON, W.C.1

Specialists in Light Sensitive Work

AUTOMATIC CONTROL of STREET and FACTORY LIGHTING

Increasingly in demand as the most efficient and economical control

Phone : Holborn 2986

(17)

SIEMENS

38-39, UPPER THAMES STREET, LONDON, E.C.4.

ELECTRIC LAMPS of all types. ELECTRIC LIGHT FITTINGS. FLOODLIGHTING APPARATUS. SHOP-WINDOW LIGHTING EQUIPMENT. STORE LIGHTING. INDUSTRIAL LIGHTING. CINEMA LIGHTING, ELECTRIC SIGNS, Etc.

(18)

STRAND ELECTRIC

AND ENGINEERING CO. LTD.

19-24, FLORAL STREET, LONDON, W.C.2

Specialists in Modern Theatrical Lighting

Manufacturers of "Sunray" Lighting Equipment

Electrical Installation Contractors. Lighting Schemes for

Theatres Floodlighting Exhibitions Cinemas Pageants
Shop Windows Dress Parades Ballrooms Tea Lounges

Illuminated Road Traffic Signals

A CORRECTION.

We much regret that an error appeared in the summary of Capt. Liberty's recent articles on the above subject, dealt with in our last (August) issue. The opening four lines of the final section on page 192 should read:—

"PEDESTRIAN AND OTHER SIGNALS.

Pedestrian signals can be worked on the automatic system, but on the whole pedestrians are best catered for by push-button systems. In these the light signal remains green to the road until a pedestrian . . ."

Unfortunately in the process of printing the type of the title and the first four lines of the section entitled "Traffic Actuated Signals" in the preceding column was substituted.

Teachers of Building Visit Lighting Service Bureau

An interesting event on July 25th was the visit of over 50 teachers of building to the Lighting Service Bureau, at 2, Savoy Hill, London, W.C.2.

The visitors showed both interest and enthusiasm during their tour of the lighting demonstration rooms. Mr. Lingard, chief of the Engineering Department at the Bureau, gave a talk on the fundamental principles of electric lighting. He was followed by Mr. Maitland, A.R.I.B.A. (until recently in charge of the Architectural Department at the Bureau), who spoke on architectural lighting, making particular reference to the structural effects to be obtained.

After a lively discussion had taken place, a vote of thanks to the lecturers, and to the staff of the Bureau, was proposed by Mr. W. Gintor, of the Board of Education, who said that he had seldom spent a more useful and instructive afternoon. He felt that the Bureau was doing most valuable work in its campaign for better lighting.

Demonstrations of Public Lighting Equipment in Margate

In accordance with the usual practice (whereby organized displays are held biennially) there will be no officially arranged exhibition in connection with the tenth Annual Conference of the Association of Public Lighting Engineers in Margate this year. We understand, however, that a number of firms have arranged to display new types of lamps and lighting equipment in certain streets; interesting novelties include several types of electric discharge lamps and improved forms of gas lamps (both low and high pressure).

Amongst those who have undertaken to take part in this display are:—

GAS LIGHTING.

James Keith & Blackman Ltd.; new types of high-pressure gas lamps.

Brompton Tube Co. Ltd.; provision of steel columns for use with the above.

Wm. Sugg & Co. Ltd.; latest types of low-pressure gas lamps and demonstration of flood-lighting flower-beds and shrubberies by gas.

C. H. Kempton & Co. Ltd.; new double-way reflector lamps.

Horstmann Gear Co. Ltd.; clock-controllers of the latest type.

Parkinson & Co. Ltd.; lamps equipped wtih directional reflectors, etc.

Gas Meter Co. Ltd.; clock-controllers for use with the above.

Holophane Ltd.; refracting glass dishes for the scientific direction of light from public lamps.

ELECTRIC LIGHTING.

British Thomson-Houston Co. Ltd.; special fittings equipped with "Mazda-Mercra" electric discharge lamps.

Engineering and Lighting Equipment Co. Ltd.; new types of directional street-lighting fittings.

General Electric Co. Ltd; decorative fittings equipped with Osram gasfilled lamps and "Osira" and electric discharge lamps. Also floodlighting of winter-garden lawns, terraces, etc.

Siemens Electric Lamps & Supplies Ltd.; demonstration of Siemens "Sieray" hot-cathode lamps and floodlighting tubes and fittings.

Fuller particular of all these displays and of their localities will be furnished at the Conference, which opens in Margate on September 4th.

28th E.L.M.A. Illumination Design Course

As we go to press we receive particulars of the twenty-eighth E.L.M.A. Illumination Design Course, which will take place at the E.L.M.A. Lighting Service Bureau (2, Savoy Hill, London, W.C.2), on successive Monday evenings from October 16th to November 20th. An attractive series of lectures has again been arranged, and those anxious to attend should get in touch with the Bureau.

Particulars are also given of the itinerary of the Lighting Service Bureau Touring Demonstration. During September and October the demonstration van will successively visit Wells, Burnham-on-Sea, Weston-Super-Mare, Bristol, Stroud, Cinderford, Melksham, Devizes, Bath and Worcester. We understand that the visit to Crewkerne and Axminster in July was most successful, over 300 people being interested in better lighting.

The Lighting Service Bureau

A recently issued booklet obtainable from the E.L.M.A. Lighting Service Bureau tells something of the work there undertaken and describes the equipment of the new premises at Savoy Hill. The booklet bears an original cover in black and gold, and contains many pleasing illustrations. In the opening section an odd comment on electric light attributed to Stevenson is quoted ("a cold, malicious glare fit only to illuminate the corridors of our lesser lunatic asylums"!). We feel confident that if Stevenson could visit the Bureau to-day he would withdraw the harsh criticism—singularly ill-adapted to the electric lighting of to-day. The arrangements at the Bureau are familiar to many of our readers, but all of them will nevertheless be interested in the attractive pictures showing the architectural-lighting room, the committee-room (with artificial skylight), the model street and the home-lighting demonstrations. Personally, we have always considered the various side-shows cleverly arranged in the general demonstration-room (which is also here illustrated) to be amongst the most attractive new features at the Bureau. Inside the cover there is a list of the handbooks and booklets issued by the Bureau, steadily growing in number.

The E.L.M.A. touring demonstration van, an enterprising departure which was recently the subject of reference in this journal, is also illustrated.

Contracts Closed

The following contracts are announced:—

THE EDISWAN ELECTRIC CO. LTD.:—

The General Post Office; for the supply of carbon-filament lamps for twelve months, and for the supply of 12,500 telephone switchboard lamps.

Southern Railway; for the supply of electric lamps during the twelve months commencing September 1st, 1933.

THE GENERAL ELECTRIC CO. LTD.:—

The Admiralty; for the supply of various types of Osram electric lamps.

General Post Office; for twelve months' supplies of Osram metal-filament, gasfilled and vacuum lamps in pearl and clear finishes; also Robertson carbon-filament lamps.

Southern Railway Co.; for Osram metal-filament, gasfilled and vacuum lamps, pearl and clear finishes, including train-lighting type; also Robertson carbon-filament lamps for twelve months.

Weardale Steel, Coal & Coke Co. Ltd.; for the supply of Osram and Robertson electric lamps.

Clyde Navigation Trustees, Glasgow; for the supply of Osram and Robertson electric lamps for the next twelve months.

H.M. Office of Works, Metropolitan Water Board and *Purfleet U.D.C.;* for the supply of Osram electric lamps for the next twelve months.

Surrey County Council; Osram electric lamps for the next seven months.

City of Newcastle-on-Tyne; Osram electric lamps for the next six months.

SIEMENS ELECTRIC LAMPS AND SUPPLIES LTD.:—

H.M. Office of Works, Post Office (Stores Department), Southern Railway, City and County of Newcastle-on-Tyne and *Epsom Urban District Council;* for the supply of electric lamps for the next twelve months.

Printed by Taylor Garnett Evans & Co. Ltd., Manchester and London.